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Vol. XIII, No. 26. December 21, 1916

THE JOURNAL OF PHILOSOPHY
PSYCHOLOGY AND SCIENTIFIC METHODS

CHARLES SANDERS PEIRCE

Peirce as a Philosopher

CHARLES S. PEIRCE called himself, in his later years, simply a logician. That he was a philosopher he fully recognized. But the term logician seemed to him more apt for a person engaged in the researches to which he was most devoted. For Peirce, rightly, logic would constitute the best possible foundation for a sound philosophy. But most philosophers, as he very correctly saw, were not logicians and would not be likely to become such until some very great reform occurred. Peirce united very wide knowledge of the history of philosophy with a generally fair-minded disposition to a discriminating criticism of philosophers, and with a capricious, though generally very well restrained interest in philosophical polemic, whose arts he regarded with a general skepticism and pursued with a usual moderation. But all the more he felt that the name logician stood rather for what the philosopher ought to be than the name philosopher for what a well-trained logician was most likely to be. So it was as logician that he wanted to be judged.

Nevertheless he was a philosopher. Like a good many other recent philosophers, he desired his philosophy to be what is so often called scientific. He desired that the methods of the various natural sciences, and in particular of the most exact natural sciences, such as physics and chemistry, should be the models of his philosophical speculations. He had a better right to use the term scientific philosopher than is customarily the possession of those who use this term. His early training here in Cambridge, in his father's house and in the Lawrence Scientific School, was, first, in mathematics (since his father, Professor Benjamin Peirce, the elder, was one of the greatest American mathematicians). Peirce was fond of saying that he grew up in a laboratory. Later, he did some good work in the observatory. Still later, he was busy with the conduct of a good many statistical researches in connection with the Coast Survey. He was early and long familiar with exact measurement, and with the

theory and practise of the determination of the errors of measurement in the measuring sciences. So, when he spoke of being a scientific philosopher, he was not without a really close knowledge of what scientific method in philosophy ought to mean. That in addition he did not fail to appreciate some at least of the great historical thinkers was due to his wide, manifold, and in some respects, very thorough erudition—an erudition that remained, like many other of his personal possessions, somewhat capricious, despite its frequent thoroughness. At any rate, whether he worked in any one of his publications rather as logician or as general philosopher, Peirce had no interest in founding a school, belonged to none of the existing schools, had a wide range of appreciation for other minds, and a very great disposition to bind inductive methods with speculative interests.

That Peirce should be classed amongst the evolutionists is, for many reasons, natural. His early education was finished, and his maturer scientific work begun, in the great decades of the modern evolutionary movement. His principal contribution to fundamental logical theory, that is, his own highly technical definition of the three categories or modes of being,[1] which he made fundamental in all his speculations, was published in the year 1867 in the "Proceedings of the American Academy of Arts and Sciences in Boston." His essays on scientific method in the *Popular Science Monthly* were printed in the early seventies,—I believe from 1873 to 1876. "The Studies in Logic," by the members of the Johns Hopkins University, a book composed partly by himself and partly by his advanced students in logic at Baltimore, was published in the early eighties. Thus, his work brings him into close contact with the formative period of the modern doctrine of evolution.

But Peirce was never a follower of Spencer, whose relation to natural science was not such as seemed satisfactory to a mind of Peirce's type and training. Nor was Peirce very prominently influenced by Darwin, although, of course, he knew Darwin well. For Peirce was, once for all, a man rather of physical and chemical training and of practise in the use of various instruments of precision, than a man at all carefully trained in the biological sciences. His interest in human nature was wide and varied, and, in his fragmentary way, he contributed notably to the study of various psychological problems—in particular, to problems relating to the threshold of sensation, and to various other problems of the psychology of perception.

[1] (1) Things, that is, individuals; (2) objects of conception, that is, universals; and (3) signs. Peirce often mentioned, in conversation, these "three sorts of being" as the essential feature of his philosophy.

The "evolution" of Peirce was therefore no variation of the evolutionary philosophy of Spencer or of Spencer's disciple, Fiske. Such minds left him uninterested. History, and especially the history of thought, and in particular of the various natural sciences, interested Peirce deeply. But his mind, when he thought of evolution, turned its attention to the matters which most fascinated him as a logician. He wanted to know not merely about the evolution of any one group of physical phenomena, whether stellar or terrestrial, whether organic or inorganic. He wanted to know about how the laws of nature came to be what they now are. For him the doctrine of evolution was to be, if it should succeed at all, a doctrine of the evolution of the laws of nature, a doctrine regarding how the world came to acquire not the plants, nor the animals, nor the solar systems, nor the Milky Way, that now it has, but how the laws of nature came to be what they are at all.

Peirce's speculations upon these topics were very highly original, were continued over a period of very many years, were perhaps the most characteristic productions of his whole personal character and mental interest which, apart from his technical logical researches, we possess. These speculations very greatly interested William James and played their part in the formulation of that whole "philosophy of change" on which William James's latest interests were most centered. Yet to James the principal illustrations of this doctrine of the evolution of natural law always remained unfamiliar and somewhat too technical, so that James listened, in company in which I was sometimes privileged to be present—listened, I say, to these aspects of Peirce's philosophy with an interest which certainly did not follow Peirce's thought into precisely those regions which Peirce himself most valued. The ideas here in question are so manifold and complex that I can not hope to give you any adequate idea of them. Let me simply indicate a few of them.

Most philosophers, if they concern themselves with the laws of nature at all, begin by regarding certain fairly simple laws, as, so to speak, the only examples of canonical and legitimate sorts of natural law that we ought to recognize. Mechanical laws or exactly quantitative laws or formulas capable of precise natural formulation, these such philosophers regard as the reasonable sorts of law. In case a man does not believe that these types of law are universal, are pervasive, or are canonical, his philosophy is usually likely to be some sort of teleology, or some doctrine that freedom, or that spiritual significance rules the world, and that exact law is subordinate to more or less sentimentally conceived ideals.

But Peirce's philosophy was dominated by quite other modes of

thinking whose origin lay partly in his experience in dealing with the problem offered by the efforts of science to eliminate or to reduce to rule the errors which are encountered in the actual measurements which the physical sciences endeavor to make. Partly his ideas on these subjects were due to still more general logical considerations which influenced him greatly from the time they first met his notice. The laws of nature that we actually confirm—so Peirce was accustomed to say—are laws which, so far as we can verify them, are *approximately* true. All measurements are inexact, and have to be corrected by further measurements. The moon which astronomers observe, especially if the observations extend over many centuries, as, by the study of the records of ancient eclipses we can make them extend—the moon of observation—never agrees precisely with the ideal moon which the astronomical theory demands. Of course as astronomical knowledge grows toward perfection, the discrepancy between theory and fact grows less. That is simply because the better we know nature, the more we can discover how to adjust theory and fact, one to the other. But if we extend our survey of nature from the instant to the year, from the year to the century, from the century to the geological period, or to the evolution of a stellar system, we get evidence that natural laws which hold with appreciable exactness and within the errors of probable observation, during short periods of time, no longer hold with such precision for very long periods of time. There is a reasonable inductive evidence that the laws which nature follows are themselves only approximately true and are subject to evolution, so that Newton's law of gravitation is presumably very nearly true at the present time for the present moon and planets, for the present stellar systems. But it is equally probable that this law is even now only a close approximation, not an absolutely necessary order of things. For similar inductive reasons, it becomes probable that, in so far as Newton's law of gravitation now holds true, it did not always hold true, and that this, like all other laws of nature, is a product of evolution.

What an inductive study of nature makes probable, Peirce was accustomed to regard as what the rightly trained mind of the logical student of nature would regard as that which would be likely to be characteristic of a nature in which evolution has taken place. For Peirce rejected, upon logical grounds, the doctrine that the natural world or any other portion of the universe known to us, must necessarily be subject to any *a priori* laws, except the purely logical ones, or to a perfectly exact law of causation. Regularity, as Peirce was especially fond of saying, is not necessarily a self-evident type of any real world which is known to us. Regularity, where it exists and in

so far as it exists, is precisely that aspect of the world *which most stands in need of explanation.* If you find a pack of cards lying in confusion, you suppose that to be the natural result of their having been thrown down in a chance way by somebody whose dealings with them were governed by no necessary, rigid, or precise law. That is, the chance disorder of the pack of cards thrown down at random needs, on the whole, no explanation. But if you find the cards in some precise order, as, for instance, in the order required by a certain hand in a certain game, then you stand in the presence of a fact which needs explanation. You very properly and logically ask why they came to be in this order.

Precisely so the relatively chance order of the starry heavens in the region of the Milky Way calls for no scientific explanation. But if the planets conform to Kepler's laws, if the moon of astronomical theory approximately agrees with the moon of observation, it is, logically speaking, a fair question to ask why the planets and the moon behave thus, or, in evolutionary terms, how they came to do so.

Precisely so Newton's laws of motion, in so far as they are approximately true of the physical world, demand an explanation and an evolutionary explanation. If such can be hypothetically furnished, we thereby come to see why and how the Newtonian natural laws have come to characterize the real world.

Thus every sort of natural law, precisely in so far as it is approximately exact law, logically demands, if possible, an explanation in terms of the theory of the evolution of natural law. And, empirically speaking, as Peirce was never weary of insisting, there is a wide range of empirical evidence that the present laws of nature are the products of an evolutionary process. In this thought consisted the evolutionary theory of Peirce. A brief mention now of some of his other leading ideas must close this essay on his philosophy.

The second of Peirce's leading ideas dominated his highly remarkable and original version of inductive logic. I have sometimes ventured to call this doctrine by a name which Peirce himself, in some of his early papers, suggests by his illustrations, though I believe that he had never formally used it. This name is the "Insurance Theory of Induction." I have no time to expound it here. It was originally set forth in the series of articles in the *Popular Science Monthly* entitled "Illustrations of the Logic of Science."

The third leading idea of Peirce's philosophy to which I wish to direct attention results from his theory of the evolution of natural law, and expresses the result of his most synthetic survey of cosmological problems. This is the theory according to which chance is objective, and the whole universe expresses a process that has two

extremes, with chance as a limit towards one end and rigid necessity as a limit at the other end of an endless temporal process.

The fourth of Peirce's leading ideas relates to the teleological and mental aspect of the world, that is, to the idealistic tendency which formed a motive in Peirce's thought, but which never became amplified in a dogmatic idealistic metaphysics. This idea had a certain similitude to ideas which Bergson has recently made interesting, though there is never very close agreement between Peirce's ideas and those of Bergson. But Peirce has his own theory as to the part which intuition plays in the work of the human mind and in the guidance of scientific research. Peirce's thoughts on this subject are fragmentary. Indeed his entire life work may in a certain sense be called fragmentary. Yet it is my belief that his ideas will amply repay study. As he himself says in the conclusion to that brilliant essay, "The Architecture of Theories,"—"may some future student go over this ground again and have the leisure to give his results to the world."

The Peirce Manuscripts

All the remaining papers of Peirce have now been placed under the joint care of the Harvard department of philosophy and of the Harvard library. The papers are in many ways fragmentary, but may be regarded with confidence as containing some very important things. We have also in our possession copies of his various published essays, which are also somewhat fragmentary and which in their orginal publications were pretty widely distributed in various journals and learned transactions. A word about these seems in order before passing on to a description of Peirce's unpublished papers and manuscripts.

Of Peirce's published works the most important from a purely scientific standpoint was a photometric research upon a group of stars selected for that purpose by Professor Pickering, the results of this research being still valuable, despite the changes in modern methods which have taken place in the field.

Another contribution of Peirce's to the world's storehouse of scientific knowledge is none the less valuable because it is generally unknown. I refer to the scientific vocabulary of the first edition of the Century Dictionary, of which Peirce was the author in so far as that portion of the Century Dictionary had any one author at all. Peirce's vast erudition in the history of science and particularly his familiarity with scholastic philosophy to which he was long devoted made his work as a dictionary-maker exceedingly valuable.

Nearer to philosophy one comes perhaps when one speaks of Peirce's researches on the algebra of logic and in particular in the

logic of relatives. Many of the most recent researches, including those of Bertrand Russell, are still due to his influence, although Russell, as I think, has a somewhat inadequate sense of his own generally indirect indebtedness to Peirce's work in this field. The logical essays of Peirce which deal with synthetic logic and with the logic of relatives were collected and brought into a sort of a synthesis by Schroeder. A list of them can be found in Schroeder's "Algebra der Logic" (Appendix to Vol. 1).

Distinct from these researches in exact and, in general, in deductive logic are Peirce's manifold contributions to the logic of induction. The most important essays of Peirce in this field appeared in the early seventies of the last century in the *Popular Science Monthly* under the general heading of "Illustrations of the Logic of Science." Of the researches of Peirce on this subject, I do not hesitate to say that they are still very imperfectly appreciated and are of enormous importance.

As is well known, William James considered Peirce as the father of pragmatism. Yet what little Peirce published on this subject will go to bear out the remark that there is little in common between his pragmatism and that of James. Peirce's *Monist* article entitled "The Issues of Pragmaticism" was written for the express purpose of maintaining the independence of his thought from either the pragmatism of James or the humanism of Schiller. The word practicism seemed to him best to describe the philosophy of these two thinkers. As for Peirce himself, when he saw his pragmatism threatened with too much popularity he found it easy to take refuge in a new word, namely, "pragmaticism" which, as he liked to say, "seems ugly enough to escape the kidnappers."

It is not always easy to understand Peirce. He never regretted the fact that most people found it hard to follow his ideas. He deliberately chose that most of his researches should be concerned with highly technical topics and should be secure from the intrusion of the uncalled. Upon occasion he could be brilliantly clear in his expressions of highly complex and recondite problems, although this clearness was a capricious fact in his life and in his writings, and was frequently interrupted by a mode of expression which often seemed to me to be due to the fear, after all, that in case mediocre minds found themselves understanding too many of his ideas, they would be led to form too high an impression of their own powers. One finds this tendency towards what might be called "impenetrability" especially evident in his manuscripts. Too often the reader meets with a thought of surpassing brilliancy and follows it eagerly, only to have it disappear like the cuttlefish in an inky blackness of its own secretion.

The most complete manuscripts of the Peirce collection include copies of the "Lectures on Pragmatism" which were delivered privately to a circle of friends in Cambridge and of the Lowell Lectures on Logic of 1903–4. It was these latter which James described as "flashes of brilliant light relieved against Cimmerian darkness—"darkness" indeed to James as to many others must have seemed those portions on "Existential Graphs" or "Abduction." Yet it seems strange that the very striking lectures on "Induction," "Probability," "Chance," and "Multitude" should have attracted nothing more than a passing notice.

The two works, which, if they could ever have been completed, were intended by Peirce to be the proper fruits of his studies, were a "History of Science" and a "Comprehensive Treatise on Logic." Both of these remain unfinished; and the value of his fragmentary manuscripts will largely depend upon the extent to which future editorial work can bring into unity the very considerable fragments which his remains contain of the studies which were intended to form part of these works. So far as his erudition and inventiveness were conditions for the writing of these two intended books, Peirce possessed both these characters most abundantly. No greater mind has ever appeared in America in respect of the powers needed for the writing of these two projected works. No more ample erudition has ever existed amongst us regarding the topics which were here in question.

Of especial importance from an historical standpoint are the writings of Peirce which deal with Aristotle and with the scholastic philosophy. Aristotle, Peirce read in the original carefully and for many years, and his manuscripts contained many original expressions of his independent opinion about the problems connected with the interpretation of the Aristotelian philosophy. For the scholastic philosophy Peirce always had a very great interest. Duns Scotus was among his favorites, both as logician and as metaphysician. He was not attracted to the Scholastics by any of their theological relations, but by an interest in their skilfully devised vocabulary, and in the beautiful array of their word conceptions. A treatise which I recently found among his manuscripts entitled "Duns Scotus and Occam" sets forth very clearly the issues of realism and nominalism in the light of modern thought and goes far towards showing that many contemporary philosophers, as, for instance, Bertrand Russell, are not so far away from scholasticism as the calendar might indicate.

The following constitutes a list of the titles of the more important among the Peirce manuscripts. It is far from being complete, yet it may serve to suggest the varied and in many respects original nature of Peirce's philosophical and scientific researches.

"On Retroduction, Induction, and Abduction." "Minute Logic." "Treatise in Logic": Chapter I, "Prelogical Ideas"; Chapter IV, "Ethics"; Chapter VI, "The Three Kinds of Signs"; Chapter VII, "The Aristotelian Syllogistic"; Chapter VIII, "The Algebra of the Copula"; Chapter XI, "On Logical Breadth and Depth"; Chapter XIII, "Simplification of Dual Relatives"; Chapter XIV, "Quantification of the Predicate"; Chapter XV, "Existential Graphs." "Synechism." "Lectures on the British Logicians." "Positivism." "Aristotle on Categories." "Molecules and Molecular Theory." "Prospect of Air Sailing." "On Representation." "On small Differences in Sensation." "Notes on Royce's World and Individual." "Illustrations of Dynamics." "Theory of Numbers." "Refutation of Transcendentalism." "*A Priori* and *A Posteriori.*" "The Seven Systems of Metaphysics." "Quantity and Quality." "On Multitude and Number." "Logic of History." "Lectures on Kant." "On Mind and Matter. "Logic of Continuity." "On the Associations of Ideas." "Spinoza." "Hume—a Critical History of Logical Ideas."

JOSIAH ROYCE,
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THE PRAGMATISM OF PEIRCE

THE term pragmatism was introduced into literature in the opening sentences of Professor James's California Union address in 1898. The sentences run as follows: "The principle of pragmatism, as we may call it, may be expressed in a variety of ways, all of them very simple. In the *Popular Science Monthly* for January, 1878, Mr. Charles S. Peirce introduces it as follows:" etc. The readers who have turned to the volume referred to have not, however, found the word there. From other sources we know that the name as well as the idea was furnished by Mr. Peirce. The latter has told us that both the word and the idea were suggested to him by a reading of Kant, the idea by the "Critique of Pure Reason," the term by the "Critique of Practical Reason."[1] The article in the *Monist* gives such a good statement of both the idea and the reason for selecting the term that it may be quoted *in extenso.* Peirce sets out by saying that with men who work in laboratories, the habit of mind is molded by experimental work much more than they are themselves aware. "Whatever statement you may make to him, he [the experimentalist] will either understand as meaning that if a

[1] See article on "Pragmatism," in "Baldwin's Dictionary," Vol. II., p. 322, and the *Monist,* Vol. 15, p. 162.

given prescription for an experiment ever can be and ever is carried out in act, an experience of a given description will result, or else he will see no sense at all in what you say." Having himself the experimental mind and being interested in methods of thinking, "he framed the theory that a *conception,* that is, the rational purport of a word or other expression, lies exclusively in its bearing upon the conduct of life; so that, since obviously nothing that might not result from experiment can have any direct bearing upon conduct, if one can define accurately all the conceivable experimental phenomena which the affirmation or denial of a concept could imply, one will have therein a complete definition of the concept, and *there is absolutely nothing more in it.* For this doctrine, he invented the name *pragmatism.*"

After saying that some of his friends wished him to call the doctrine practicism or practicalism, he says that he had learned philosophy from Kant, and that to one "who still thought in Kantian terms most readily, *praktisch* and *pragmatisch* were as far apart as the two poles, the former belonging to a region of thought where no mind of the experimentalist type can ever make sure of solid ground under his feet, the latter expressing relation to some definite human purpose. Now quite the most striking feature of the new theory was its recognition of an inseparable connection between rational cognition and human purpose."[2]

From this brief statement, it will be noted that Peirce confined the significance of the term to the determination of the meaning of terms, or better, propositions; the theory was not, of itself, a theory of the test, or the truth, of propositions. Hence the title of his original article: "How to Make Ideas *Clear.*" In his later writing, after the term had been used as a theory of truth,—he proposed the more limited "pragmaticism" to designate his original specific meaning.[3] But even with respect to the meaning of propositions, there is a marked difference between his pragmaticism and the pragmatism of, say, James. Some of the critics (especially continental) of the latter would have saved themselves some futile beating of the air, if they had reacted to James's statements instead of to their own associations with the word "pragmatic." Thus James says in his California address: "The effective meaning of any philosophic proposition can always be brought down to some particular conse-

[2] Kant discriminates the laws of morality, which are *a priori,* from rules of skill, having to do with technique or art, and counsels of prudence, having to do with welfare. The latter he calls pragmatic; the *a priori* laws practical. See "Metaphysics of Morals," Abbott's trans., pp. 33 and 34.

[3] See the article in the *Monist* already mentioned, and another one in the same volume, p. 481, "The Issues of Pragmaticism."

quence, in our future practical experience, whether active or passive; the point lying rather in the fact that the experience must be *particular,* than in the fact that it must be *active.*" (Italics mine.)

Now the curious fact is that Peirce puts more emphasis upon practise (or conduct) and less upon the particular; in fact, he transfers the emphasis to the general. The following passage is worth quotation because of the definiteness with which it identifies meaning with both the future and with the general. "The rational meaning of every proposition lies in the future. How so? The meaning of a proposition is itself a proposition. Indeed, it is no other than the very proposition of which it is the meaning: it is a translation of it. But of the myriads of forms into which a proposition may be translated, which is that one which is to be called its very meaning? It is, according to the pragmaticist, that form in which the proposition becomes applicable to human conduct, not in these or those special circumstances nor when one entertains this or that special design, but that form which is most applicable to self-control under every situation and to every purpose." Hence, "it must be simply the general description of all the experimental phenomena which the assertion of the proposition virtually predicts." Or, paraphrasing, pragmatism identifies meaning with formation of a habit, or way of acting having the greatest generality possible, or the widest range of application to particulars. Since habits or ways of acting are just as real as particulars, it is committed to a belief in the reality of "universals." Hence it is not a doctrine of phenomenalism, for while the richness of phenomena lies in their sensuous quality, pragmatism does not intend to define these (leaving them, as it were, to speak for themselves), but "eliminates their sential element, and endeavors to define the rational purport, and this it finds in the purposive bearing of the word or proposition in question." Moreover, not only are generals real, but they are physically efficient. The meanings "the air is stuffy" and "stuffy air is unwholesome" may determine, for example, the opening of the window. Accordingly on the ethical side, "the pragmaticist does not make the *summum bonum* to consist in action, but makes it to consist in that process of evolution whereby the existent comes more and more to embody those generals . . .; in other words, becomes, through action an embodiment of rational purports or habits generalized as widely as possible."[4]

The passages quoted should be compared with what Peirce has to say in the Baldwin Dictionary article. There he says that James's

[4] It is probably fair to see here an empirical rendering of the Kantian generality of moral action, while the distinction and connection of "rational purport" and "sensible particular" have also obvious Kantian associations.

doctrine seems to commit us to the belief "that the end of man is action—a stoical maxim which does not commend itself as forcibly to the present writer at the age of sixty as it did at thirty. If it be admitted, on the contrary, that action wants an end, and that the end must be something of a general description, then the spirit of the maxim itself . . . would direct us toward something different from practical facts, namely, to general ideas. . . . The only ultimate good which the practical facts to which the maxim directs attention can subserve is to further the development of concrete reasonableness. . . . Almost everybody will now agree that the ultimate good lies in the evolutionary process in some way. If so, it is not in individual reactions in their segregation, but in something general or continuous. Synechism is founded on the notion that the coalescence, the becoming continuous, the becoming governed by laws, the becoming instinct with general ideas, are but phases of one and the same process of the growth of reasonableness. This is first shown to be true with mathematical exactitude in the field of logic, and is thence inferred to hold good metaphysically. It is not opposed to pragmaticism . . . but includes that procedure as a step."

Here again we have the doctrine of pragmaticism as a doctrine that meaning or rational purport resides in the setting up of habits or generalized methods, a doctrine passing over into the metaphysics of synechism. It will be well now to recur explicitly to Peirce's earlier doctrine which he seems to qualify—although, as he notes, he upheld the doctrine of the reality of generals even at the earlier period. Peirce sets out, in his article on the "Fixation of Belief,"[5] with the empirical difference of doubt and belief expressed in the facts that belief determines a habit while doubt does not, and that belief is calm and satisfactory while doubt is an uneasy and dissatisfied state from which we struggle to emerge; to attain, that is, a state of belief, a struggle which may be called inquiry. The sole object of inquiry is the fixation of belief. The scientific method of fixation has, however, certain rivals: one is that of "tenacity"—constant reiteration, dwelling upon everything conducive to the belief, avoidance of everything which might unsettle it—the will to believe. The method breaks down in practise because of man's social nature; we have to take account of contrary beliefs in others, so that the real problem is to fix the belief of the community; for otherwise our own belief is precariously exposed to attack and doubt. Hence the resort to the method of authority. This method breaks down in time by the fact

[5] *Popular Science Monthly*, Volume XII., pp. 1–15. It is much to be desired that the series of articles be printed in book form. Discussion since 1878 has caught up with Peirce, and his views would awaken much more response now than when published.

that authority can not fix all beliefs in all their details, and because of the conflict which arises between organized traditions. There may then be recourse to what is "agreeable to reason"—a method potent in formation of taste and in esthetic productions and in the history of philosophy,—but a method which again fails to secure permanent agreements in society, and so leaves individual belief at the mercy of attack. Hence, finally, recourse to science, whose fundamental hypothesis is this: "There are real things, whose characters are entirely independent of our opinions about them; those realities affect our senses according to regular laws, and . . . by taking advantage of the laws of perception, we can ascertain *by reasoning* how things really are, and any man, if he have sufficient experience and reason enough about it, will be led to the one true conclusion."[6]

It will be noted that the quotation employs the terms "reality" and "truth," while it makes them a part of the statement of the *hypothesis* entertained in scientific procedure. Upon such a basis, what meanings attach to the terms "reality" and "truth?" Since they are general terms, their meanings must be determined on the basis of the effects, having practical bearings, which the object of our conception has. Now the effect which real things have is to cause beliefs; beliefs are then the consequences which give the general term reality a "rational purport." And on the assumption of the scientific method, the *distinguishing* character of the *real* object must be that it tends to produce a single universally accepted belief. "All the followers of science are fully persuaded that the processes of investigation, if only pushed far enough, will give one certain solution to every question to which they can be applied." "This activity of thought by which we are carried, not where we wish, but to a foreordained goal, is like the operation of destiny. . . . This great law is embodied in the conception of truth and reality. The opinion which is fated to be ultimately agreed to by all *who investigate,* is what we mean by the truth, and the object represented in this opinion is the real."[7] In a subsequent essay (on the "Probability of Induction") Peirce expressly draws the conclusion which follows from this statement; viz., that this conception of truth and reality makes everything depend upon the character of the methods of inquiry and inference by which conclusions are reached. "In the case of synthetic inferences we know only the degree of trustworthiness of our proceeding. As all knowledge comes from synthetic inference, we must also infer that all human certainty consists merely in our knowing that the processes by which our knowledge has been derived are such as

[6] *Ibid.*, p. 11.

[7] *Ibid.*, pp. 298–300, *passim.*

must generally have led to true conclusions''[8]—true conclusions, once more, being those which command the agreement of competent inquiries.

Summing up, we may say that Peirce's pragmaticism is a doctrine concerning the meaning, conception, or rational purport of objects, namely, that these consist in the ''effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object.''[9] ''Our idea of anything is our idea of its sensible effects,'' and if we have any doubt as to whether we really believe the effects to be sensible or no, we have only to ask ourselves whether or no we should act any differently in their presence. In short our own responses to sensory stimuli are the ultimate, or testing, ingredients in our conception of an object. In the literal sense of the word pragmatist, therefore, Peirce is more of a pragmatist than James.

He is also less of a nominalist. That is to say, he emphasizes much less the *particular* sensible consequence, and much more the habit, the generic attitude of response, set up in consequence of experiences with a thing. In the passage in the Dictionary already quoted he speaks as if in his later life he attached less importance to action, and more to ''concrete reasonableness'' than in his earlier writing. It may well be that the relative emphasis had shifted. But there is at most but a difference of emphasis. For in his later doctrine, concrete rationality means a change in existence brought about *through* action, and through action which embodies conceptions whose own specific existence consists in habitual attitudes of response. In his earlier writing, the emphasis upon habits, as something generic, is explicit. ''What a thing means is simply what habits it involves.''[10] More elaborately, ''Induction infers a rule. Now the belief of a rule is a habit. That a habit is a rule, active in us, is evident. That every belief is of the nature of a habit, in so far as it is of a general character, has been shown in the earlier papers of this series.''[11]

The difference between Peirce and James which next strikes us is the greater emphasis placed by the former upon the method of procedure. As the quotations already made show, everything ultimately turned, for Peirce, upon the trustworthiness of the procedures of inquiry. Hence his high estimate of logic, as compared with James —at least James in his later days. Hence also his definite rejection of the appeal to the Will to Believe—under the form of what he calls

[8] *Ibid.*, p. 718.
[9] *Ibid.*, p. 293.
[10] *Ibid.*, p. 292.
[11] *Popular Science Monthly*, Vol. XIII., p. 481.

the method of tenacity. Closely associated with this is the fact that Peirce has a more explicit dependence upon the social factor than has James. The appeal in Peirce is essentially to the consensus of those who have investigated, using methods which are capable of employment by all. It is the need for social agreement, and the fact that in its absence "the method of tenacity" will be exposed to disintegration from without, which finally forces upon mankind the wider and wider utilization of the scientific method.

Finally, both Peirce and James are realists. The reasonings of both depend upon the assumption of real things which really have effects or consequences. Of the two, Peirce makes clearer the fact that in philosophy at least we are dealing with the *conception* of reality, with reality as a term having rational purport, and hence with something whose meaning is itself to be determined in terms of consequences. That "reality" means the object of those beliefs which have, after prolonged and cooperative inquiry, become stable, and "truth" the quality of these beliefs is a logical consequence of this position. Thus while "we may define the real as that whose characters are independent of what anybody may think them to be . . . it would be a great mistake to suppose that this definition makes the idea of reality perfectly clear."[12] For it is only the outcome of persistent and conjoint inquiry which enables us to give intelligible meaning in the concrete to the expression "characters independent of what anybody may think them to be." (This is the pragmatic way out of the egocentric predicament.) And while my purpose is wholly expository I can not close without inquiring whether recourse to Peirce would not have a most beneficial influence in contemporary discussion. Do not a large part of our epistemological difficulties arise from an attempt to define the "real" as something given prior to reflective inquiry instead of as that which reflective inquiry is forced to reach and to which when it is reached belief can stably cling?

JOHN DEWEY.

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CHARLES S. PEIRCE AT THE JOHNS HOPKINS

THE keenest pleasure which can offer itself to the university student who is about to grapple with the profoundest thinking that the world has done and is doing is his when he finds himself by chance in the actual presence of one of the creators of the world's store of thought. This had been the happy lot of the students of the

[12] *Popular Science Monthly*, Vol. XII., p. 298.

Johns Hopkins University from its opening days. They felt, with reason, that they were assisting at the foundation of an important new development in university life in this country. For the first time the atmosphere of the great European centers of research had been created in America. Departments headed by such men as Sylvester, Gildersleeve, Remsen, Rowland, Martin, a group of scholars all fitted to inspire their students with the ardor of research—this was something new. To this atmosphere the students of those early days, reinforced by enthusiastic young *docents* fresh from their experience of the then simple and ideal German university life, responded with due appreciation of the lucky days upon which they had fallen. Probably there has never been in this country a center of learning where the conditions were more ideal for producing in its best form the joy of the intellectual life—nor a group of students better fitted to profit by their novel opportunities. To share the life of this ardent body of workers was, they one and all felt, an experience to be remembered.

To this group of students, eager for intellectual adventure, came, in 1880–1881, Charles S. Peirce. His reputation had preceded him, and his hearers were quickly receptive to the inspiration to be had from one more master mind. Sylvester and Peirce both possessed recognized elements of the temperament of genius—a thing which adds much to the effectiveness of personal intercourse with a great man—but that temperament was exhibited in them in very different forms. Sylvester was as oblivious as Peirce of the presence of his audience (though he did once by chance discover, to his evident amazement, that his most distinguished auditor, Professor Cayley, was fast asleep, his bald head frankly covered with his handkerchief), but he had a boyish enthusiasm which was in full harmony with his fresh English color and his nervous Jewish temperament. He was always brimming over with the importance of his subject-matter, which had usually been produced during the three days' interval between his lectures, and which was brought forth with the keen joy of the immediate discoverer. Peirce, on the contrary, was of the brooding type. He sat when he addressed his handful of students (who turned out afterwards, however, to be a not unimportant handful) and he had all the air, as has been noted by Professor Jastrow, of the typical philosopher who is engaged, at the moment, in bringing fresh truth by divination out of some inexhaustible well. He got his effect not by anything that could be called an inspiring personality, in the usual sense of the term, but rather by creating the impression that we had before us a profound, original, dispassionate and impassioned seeker of truth. No effort was made to create a connected and not inconsistent whole out of the matter of each lecture. In fact,

so devious and unpredictable was his course that he once, to the delight of his students, proposed at the end of his lecture, that we should form (for greater freedom of discussion) a Metaphysical Club, though he had begun the lecture by defining metaphysics to be "the science of unclear thinking."

Several of Professor Sylvester's students—understanding that the New Logic which Professor Peirce professed had connections with existing mathematics and that, even if it had not, it was something which, unlike the mechanical logical exercises of the schools, was expected to have a vivifying and clarifying effect upon one's actual reasoning processes—joined his class in logic, composed otherwise, of course, of students of philosophy. This mixed character of the audience, as is too often the case in lectures on modern logic, made it impossible for the lecturer to adapt his subject-matter with exactness to the needs of either part. Peirce's lectures did not go very extensively into the details of his mathematical logic (Symbol Logic, I maintain, is the only proper name for it, and I note with pleasure that Dr. Karl Schmidt has adopted this term). His lectures on philosophical logic we should doubtless have followed to much greater advantage if he had recommended to us to read his masterly series of articles on the subject which had already appeared in the *Popular Science Monthly* in 1878 under the title "Some Illustrations of the Logic of Science." We should have had from these at first hand a better idea of "how to make our ideas clear" concerning the methods of science as he understood them. But that, in spite of his apparent aloofness and air of irresponsibility, he really had the interests of his hearers deeply at heart will appear from a sympathetic letter which he wrote me some years later, when I came to lecture myself on logic at the Johns Hopkins University:

MILFORD, PA.
Thanksgiving Day, 1902

My dear Mrs. Franklin: It gives me joy to learn that you are to lecture on logic at the Johns Hopkins. But, oh, you will not have such a wonderful and charming class as I had, especially the first year. In those days I knew very little about logic, and did not even thoroughly understand upon what logic is based. I was not in possession of the proof that the science of logic must be based on the science of ethics, although I more or less perceived that sound reasoning depends more on sound morals than anything else. I at any rate tried hard to see what I was about, and not to build logic upon anything that must on the contrary be built upon it. In a certain measure I appreciated the precise nature of the utility of logic, and rated it high; but I did not know what I know now. I am finding out every day something new to me in logic.

I wish most earnestly that you may succeed in animating your students with the true spirit of science and of logic, and that is the very

greatest happiness I could wish for you. Whether you do or not depends chiefly on how much you care to do so.—I return Keynes.

Very faithfully,

C. S. PEIRCE.

P. S. I hope that Schröder's manuscripts will be printed. I would do anything in my power to that end. Can't you find out what is needed?

The following letter, which I have quoted in part, indicates, among other things, the extreme value which Peirce attributed to his form of pragmatism. The important collection of his reprints which he presented to me at this time, I have now deposited in the library of Columbia University. This letter, too, is not so much a personal letter as it is a definitive setting out of some of his views and experiences; if he has left no complete autobiography, it should furnish important material concerning the wonderful intellectual life which he took part in, in Cambridge, during his early years.

My dear Mrs. Franklin: It is most kind of you to think of me and of doing what you propose, and it happens that, just at this time, it would be very serviceable to me. For in a forthcoming number of the *Monist,* I am to have an article about pragmatism, explaining what I conceive it to be. Although James calls himself a pragmatist, and no doubt he derived his ideas on the subject from me, yet there is a most essential difference between his pragmatism and mine. My point is that the meaning of a *concept* . . . lies in the manner in which it could *conceivably* modify purposive action, and *in this alone.* James, on the contrary, whose natural turn of mind is away from generals, and who is besides so soaked in ultra-sensationalist psychology that like most modern psychologists he has almost lost the power of regarding matters from the logical point of view, in defining pragmatism, speaks of it as referring ideas to *experiences,* meaning evidently the sensational side of experience, while I regard *concepts* as affairs of habit or disposition, and of how we should react. Without particularly referring to him, my *Monist* article (already sent in and accepted) is to explain what my position is; and I desire to follow it up by two others, of which the first shall show how this principle at once affords solutions of a great variety of problems, and shall show what the general color of those solutions is, while the third article shall show what facts and phenomena I appeal to as proving the truth of the pragmatist principle. But it is altogether problematical whether the second and third articles ever appear. It all depends upon whether the readers of the *Monist* are interested in the first article. Now if you were to write what you propose, it would call attention to the first article, increase the sales of that number of the *Monist,* and render the acceptance of a second much more likely. I have no fears but that the second should excite of itself sufficient interest to insure the third; but the first, being a definition of an individual opinion, is not calculated to attract new readers.

It is true that I have not received much credit either for pragmatism or any other part of my work. However, as it was not done for the sake

of anything of that kind, I have no reason to complain. What I expected to gain when I did it, I have gained. I began on the scale of printing a logical research every month. My motive then was a mixed one. I wanted the statement of my results in print for my own convenience in referring to them, and I thought it would be a gain to civilization to have my entire logical system. But after a very few months, I found that nobody took any notice of my papers, and I lost all interest in their publication, and simply filed away my mss. for my own use.

It must have been about 1857 when I first made the acquaintance of Chauncey Wright, a mind about on the level of J. S. Mill. He was a thorough mathematician of the species that flourished at that time, when dynamics was regarded (in America) as the top of mathematics. He had a most penetrating intellect. There were a lot of superior men in Cambridge at that time. I doubt if they could have been matched in any other society as small that existed at that time anywhere in the world. Wright, whose acquaintance I made at the house of Mrs. Lowell, was at that time a thorough Hamiltonian; but soon after he turned and became a great admirer of Mill. He and I used to have long and very lively and *close* disputations lasting two or three hours daily for many years. In the sixties I started a little club called the Metaphysical Club. It seldom if ever had more than half a dozen present. Wright was the strongest member and probably I was next. Nicholas St. John Green was a marvelously strong intelligence. Then there were Frank Abbott, William James, and others. It was there that the name and the doctrine of pragmatism saw the light. There was in particular one paper of mine that was much admired and the ms. went around to different members who wished to go over it more closely than they could do in hearing it read. While I was in charge of the Coast Survey office in 1873, I employed some Sundays in putting that piece into a literary form, though without any intention of printing it. But in 1875 or 1876 I met old William Appleton, the publisher, on a steamer, and he offered me a good round price for some articles for the *Popular Science Monthly*. I patched up the piece I speak of for the first; and it appeared in November, 1877. In the autumn of 1877 I went abroad in order to urge a certain truth upon the Geodetical Association. As I should have to speak in French and conduct a discussion in that language, by way of practise I began and finished on the voyage between Hoboken and Plymouth an article about pragmatism in French. I afterward translated into French my article of November, 1877, and these two appeared in the *Revue Philosophique*, about Volume VI. I left in the library of the J. H. University a bound volume of my pieces containing these two. I have not a copy of either now. I should say that the *word* pragmatism does not appear in that article, nor did I insert it in the Century Dictionary or ever use it in print previous to the article in Baldwin's Dictionary. I translated the steamer article into English and in that dress it appeared in the *Popular Science* of January, 1878, some time previous to the publication of the original text.

There never was the smallest disloyalty on James's part. On the contrary, he has dragged in mention of me whenever he could.

In the spring of 1903 I was invited, by the influence of James, Royce,

and Münsterberg, to give a course of lectures in Harvard University on Pragmatism. I had intended to print them; but James said he could not understand them himself and could not recommend their being printed. I do not myself think there is any difficulty in understanding them, but all modern psychologists are so soaked with sensationalism that they can not understand anything that does not mean that, and mistranslate into the ideas of Wundt whatever one says about logic. . . . How can I, to whom nothing seems so thoroughly real as generals, and who regard Truth and Justice as *literally* the most powerful powers in the world, expect to be understood by the thoroughgoing Wundtian? But the curious thing is to see Absolute Idealists tainted with this disease,—or men who, like John Dewey, hover between Absolute Idealism and Sensationalism. Royce's opinions as developed in his "World and Individual" are extremely near to mine. His insistence on the element of purpose in intellectual concepts is essentially the pragmatistic position. . . .

Pragmatism is one of the results of my study of the formal laws of signs, a study guided by mathematics and by the familiar facts of everyday experience and by no other science whatever. It is a maxim of logic from which issues a metaphysics very easily. It solves almost all problems of metaphysics in short metre and it solves them in such a way as never to bar the way of any positive inquiry. It also has the gratifying effect of encouraging the simplest ideas of religion and anthropomorphic conceptions of the Absolute.

I have some of my quarto papers bound up together and I am sending you this volume begging your acceptance of it. I wish I had copies of some of my octavo papers bound up; but I have not. I have some loose copies of some of them which I would have bound for you; but one never knows when a binder is going to send one's books home. One only knows that he will try to do so in time to get the bill paid before both parties die. So I send such papers as I can find, as they are, along with a few newspapers containing articles on "French Academy," "Napoleon Bonaparte," "Great Men of the Nineteenth Century," etc.

With best regards to Mr. Franklin,

Very faithfully,

C. S. Peirce.

Professor Peirce had a mind of great originality and productiveness; he lacked, no doubt, as do too many geniuses, that keen self-criticism which would have enabled him to distinguish rigidly, in what he produced, between the wheat and the chaff. Much of what he wrote, especially during the later years of his life, was incomprehensible beyond even the privilege of the maker of new philosophies; articles in the *Monist* which William James has said will be a rich mine for the future student will just as probably remain forever indecipherable by him. Once when I was in search of an article of his which had lately appeared in the *Monist*, entitled, in Shakespeare's phrase, "Man's Glassy Essence," and could not remember its name,

the young librarian who assisted me said, "Oh yes,—you mean the article on 'Glacial Man' "—a title which would doubtless have served as well as the other. Indeed, many of his contributions to the philosophical dictionary were of the purely cabalistic type. The second part of the article on Symbolic Logic, for instance, was finally, against the urgent advice of Professor Couturat, who had himself contributed the admirable first part, sent to the printer, though it is doubtful if any one will ever be able to read it.[1] But it will never be known what reams of closely written matter were excluded! Professor Peirce had already completed a great part of a book on logic, largely medieval logic, which (save for what came out in the Dictionary) he was never in a position to publish: his future disciples will no doubt see to it that this great work is eventually given to the press. So difficult at the time, however, was the rejection, in the interest of sanity, of such a mass of closely written pages that at last I found it necessary to call in the aid of my husband, who undertook to play the traditionally unpleasant rôle of the candid friend. The ingrained sweetness of Peirce's character—an essential to the acceptance of irksome criticism—is here brought into evidence; in fact, this bit of correspondence may perhaps be regarded as a model of its type,—no easy type.

[MILFORD, PA., Nov., 1900.]

My dear Mrs. Franklin:

I want you kindly to read the enclosed article Exact Logic and show it to your husband whose judgment I have much faith in, if he will be so good as to look at it. I told Prof. Baldwin when I took up this work that I should expect "unlimited swing" in exact logic. Still, I don't know but it is too much to ask him to print this; and I don't want to ask what is not right. The purpose of it is to put Exact Logic in its place as a branch of philosophy. It is an extremely careful statement of the small ground it covers. I do not see how I could say less without reducing it to a general statement that would be without force. I am too close to it to get a good mental sight at it. I request you to read it and tell me plainly whether it seems to you and your husband calculated to do the cause of exact logic any good, . . . also whether there are any modifications you can suggest, especially to shorten it. A short vocabulary of terms omitted in Vol. I. of the Dictionary will have to be added. You had better, I should think, follow my example in this respect in your articles, inserting, for instance, . . . I should not wonder, if you look into my Virgo symbol, but you might find it resulted in a valuable rule of elimination.

Very faithfully,
C. S. PEIRCE.

[1] The death of Professor Couturat, who was run over by a military autotruck at the beginning of the war, is one of the many irreparable losses of the European war.

My dear Mr. Peirce,

. . . I feel bound to say that, according to my notion of such a work—one, to be sure, very commonplace in comparison with that which you entertain—an article in a cooperative dictionary such as this should not be devoted to pioneer work, however eminent the writer of it, but to the exposition of what is either fairly well established and current or, if not, is capable of being so expressed within the necessary limits as to be intelligible to the ordinary properly-equipped reader. Now, the views which you lay down in your article seem to me absolutely to require for their adequately intelligible presentation far more space than you have given to them, and, *a fortiori,* far more space than the dictionary can spare. . . .

Very faithfully yours,
F. FRANKLIN.

MILFORD, PA., 1900, Nov.

My dear Franklin:

Your letter is at hand. I asked of you a disagreeable thing, and I thank you for having done it so faithfully. Would there were more courage between friends! You give me wholesome counsel, and I shall follow it, notwithstanding the suggestions of the Evil One.

Yours faithfully,
C. S. PEIRCE.

This same advice, might, I have no doubt, have been repeated to advantage under later letters of the alphabet.

If Charles S. Peirce had happened to have a longer period of activity at the Johns Hopkins University—if the years had not been cut off during which he was kept upon the solid ground of intelligible reason by discussions with a constantly growing group of level-minded students,—there is no doubt that his work would have been of more certain value than it can be affirmed to be now; it is probable, for instance, that his grateful pupil, William James, would not have found his generously provided for Lowell lectures too incomprehensible to be printed at the time. At the meetings of the Philosophical Congresse in Göttingen, in 1908, Peirce had two warm defenders of his views, as against the James form of pragmatism, in the Italian philosophers, Calderoni and Vailati. Vailati, a man of most acute intellect, is no longer living; Calderoni would no doubt be able to throw much illumination—more perhaps than any other living writer—upon the real bearing of the philosophical views of Mr. Peirce.

CHRISTINE LADD-FRANKLIN.

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CHARLES S. PEIRCE AS A TEACHER

TO record an impression of Charles S. Peirce as a teacher is a grateful opportunity. A deep conviction of the significance of the problems presented and a mastery of the intellectual processes were his sole and adequate pedagogical equipment. The logical quality was the dominant trait of his thinking; rectitude became a rational virtue. In the deductive field where premises were sharply defined and under control, the orderly development of conclusions was the true function of the well-trained mind, and the mark of the scholar. The "Algebra of Logic" was an expert tool usable only by the expert and extending the scope of the logical grasp. Deeply mathematical, his thinking had not the trace of a scholastic quality; there was no love of the tool for its own sake, but an admiration of its cutting edge as the issue of human care and skill. His interests were comprehensive, though not scattered. In the field of inductive problems the fertility of his resources imparted a breadth to his treatment that brought to the student the constant leadership of a rich mind. His knowledge never gave the impression of a burden, but of strength. His command of the history of science was encyclopedic in the best sense of the word. The hypotheses of the great thinkers of the past were transformed into logical exercises for the present-day student. The great advances of science were due as much (if not more) to an increased hold over the logical instrument as to an enlarged realm of observation. The history of science was a record of man's growth in logical stature. In dealing with the more fluid and versatile considerations of induction, as in the more rigid and closed systems of deductive reasoning, the skilled focusing of his mind excited admiration. The irrelevant was discarded, the significant composition revealed. The chips fell away and the statue in the block appeared. This sense of masterly analysis accomplished with neatness and dispatch,—all seemingly easy, but actually the quality of the highest type of keen thinking—remains as the central impression of a lecture by Professor Peirce.

When I came to the Johns Hopkins University in the autumn of 1882, Mr. Peirce's career was well established. He had inspired a remarkable group of young men, now leaders in intellectual affairs; a group to which is to be added the name of Christine Ladd-Franklin, whose exceptional abilities secured for her exceptional privileges. The "Studies in Logic" by "Members of the Johns Hopkins University" appeared in 1883. The concluding paper which Mr. Peirce contributed to the volume on "A Theory of Probable Inference" exhibits the qualities of his teaching and the charm and lucidity of his

language, and remains an admirable example of the construction of his thought and the finish of his art. I refer to it because it reflects the interplay of logical and psychological trends, which he developed as a fertile principle of interpretation. Logic was an emanation of habit; the trend was biological, the product required the schooling of discipline and the inspiration of genius. It was this side of his teaching that gave the humanistic value; out of it grew the insight that made him the father of pragmatism. The doctrine had a distinct pedagogical value; it made the student feel the reality of the discussions by adding a moderate insight to a growing capacity. "In point of fact a syllogism in Barbara virtually takes place when we irritate the foot of a decapitated frog." After developing the idea, he concludes: "Although these analogies, like all very broad generalizations, may seem very fanciful at first sight, yet the more the reader reflects upon them, the more profoundly true I am confident they will appear. They give a significance to the ancient system of formal logic which no other can at all share."

My predilections at that formative period were, I must confess, rather negative. My college course had left me with a series of dislikes, not violent, but distinctive. By elimination I enrolled as a student in philosophy. Mr. Peirce's courses in logic gave me my first real experience of intellectual muscle. Though I promptly took to the laboratory of psychology when that was established by Stanley Hall, it was Peirce who gave me my first training in the handling of a psychological problem, and at the same time stimulated my self-esteem by entrusting me, then fairly innocent of any laboratory habits, with a real bit of research. He borrowed the apparatus for me, which I took to my room, installed at my window, and with which, when conditions of illumination were right, I took the observations. The results were published over our joint names in the *Proceedings of the National Academy of Science*. The demonstration that traces of sensory effect too slight to make any registry in consciousness could none the less influence judgment, may itself have been a persistent motive that induced me years later to undertake a book on "The Subconscious."

As a further illustration of his fertile suggestiveness and use of cooperative stimulus I mention his study of great men. He prepared an elaborate question-sheet regarding the ancestry, qualities of mind and body, mode of work, stages of growth, etc., of the great men of all times. He invited a small group of students to join him in reading the chief biographies of great men and extracting the data that might furnish the entries for the syllabus. We then held conferences for the discussion and tabulation of the results. The project was

never completed. A number of years later, I was permitted to formulate two rather simple conclusions, the one relating to "Longevity," the other to "Precocity." This was done at a time when such studies were not general, though Galton's work was known. Such a conclusion as that later associated with Dr. Osler's misquoted verdict regarding the correlation of early manhood with germinal ideas, was anticipated in this study. Such were his methods.

Mr. Peirce's personality was affected by a superficial reticence often associated with the scientific temperament. He readily gave the impression of being unsocial, possibly cold, more truly retiring. At bottom the trait was in the nature of a refined shyness, an embarrassment in the presence of the small talk and introductory salutations intruded by convention to start one's mind. His nature was generously hospitable; he was an intellectual host. In that respect he was eminently fitted to become the leader of a select band of disciples. Under more fortunate circumstances, his academic usefulness might have been vastly extended. For he had the pedagogic gift to an unusual degree, had it by dower of nature, as some men handle a pencil and others the bow of a violin. It may be an inevitable result of the conventional system of education, but it is none the less a sad one, that his type of ability does not flourish readily in an institutionalized atmosphere; and no university had a more wholesome atmosphere than had Johns Hopkins in those days. The moral, if there be one, is that systems must give way to personalities, if the best talents of the best men are to be available.

The young men in my group who were admitted to his circle found him a most agreeable companion. The terms of equality upon which he met us were not in the way of flattery, for they were too spontaneous and sincere. We were members of his "scientific" fraternity; greetings were brief, and we proceeded to the business that brought us together, in which he and we found more pleasure than in anything else. This type of cooperation and delegation of responsibility came as near to a pedagogical device as any method that he used. One instance of it stands out with embarrassing clearness. To my consternation I was informed by Mr. Peirce that he would be absent at the time of the next lecture in logic, and that he would like me to present the next stage in the development of his topic to the class of graduate students. About half the hour was over, when Mr. Peirce walked in, took his place and insisted upon my concluding the exercise. I know of no more enlightening comment upon the atmosphere of the place and the day than that the procedure was accepted naturally by all concerned except myself.

It should be mentioned that during these years Mr. Peirce was

continuing his work in the Geodetic Survey and was thus carrying on a considerable range of scientific work of quite different scope. He came of a family of exact scientific men with academic traditions. It needed no change of manner or interest to set his activities in the professorial direction. By those who knew him in other relations I am confirmed in my impression that he had more pleasure in the academic pursuits. To these he turned when he retired, recognizing in his work as a scholar surveying broadly the field of intellect, the strongest bent of his versatile mind. To those who believe that for the training of the leaders of men, nothing is more inspiring and more helpful than training by example—than the privilege of association in the cooperative spirit with a master mind—the example of Charles S. Peirce will continue to remain a cherished memory. An educational policy that makes it possible to find a place for such men as Peirce in the faculties of the great universities is a worthy ambition for those who control the educational future of America.

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CHARLES S. PEIRCE AND A TENTATIVE BIBLIOGRAPHY OF HIS PUBLISHED WRITINGS

THOUGH I have not stood in any peculiar relation to Charles S. Peirce, and can not speak authoritatively on the various phases of his extraordinarily diversified intellectual activity, I can not refuse the editors' courteous invitation to add a few words of "philosophic piety" in tribute to one of the few great seminal minds that America has produced.

Many and diverse are the minds that form the philosophic community. There are, first and foremost, the great masters, the system builders who rear their stately palaces towering to the moon. These architectonic minds are served by a varied host of followers and auxiliaries. Some provide the furnishings to make these mystic mansions of the mind more commodious, while others are engaged in making their façades more imposing. Some are busy strengthening weak places or building much-needed additions, while many more are engaged in defending these structures against the impetuous army of critics who are ever eager and ready to pounce down upon and destroy all that is new or bears the mortal mark of human imperfection. There are also the philologists, those who are in a more narrow sense scholars, who dig not only for facts or roots, but also for the stones which may serve either for building or as weapons of destruction. Remote from all these, however, are the

intellectual rovers who, in their search for new fields, venture into the thick jungle that surrounds the little patch of cultivated science. They are not gregarious creatures, these lonely pioneers; and in their isolation they often completely lose touch with those who tread only the beaten paths, so that no one learns of their green pastures or knows their final burial ground. Those that return to the community often speak of strange things or use strange words; and it is but seldom that they arouse sufficient faith for others to follow them and change their trails into high roads.

Few nowadays would question the great value of these pioneer minds; and it is often asserted that universities are established to facilitate their work, and prevent it from being lost. But universities, like other well-managed institutions, can find place only for those who can work well in harness. The restless, impatient minds, like the socially or conventionally unacceptable, must thus be kept out, no matter how fruitful their originality. Charles S. Peirce was certainly one of these restless pioneer souls with the divine gift of seeing the hitherto invisible. In his early papers, in the *Journal of Speculative Philosophy,* and in his later papers, in the *Monist,* we get indeed glimpses of a vast philosophic system on which he was working with an unusual wealth of material and apparatus. He had, indeed, one of the most essential gifts of successful system builders, the power to coin an apt and striking terminology. But I am not certain that he could ever have completed this work, *i. e.,* I can not in my own imagination see how the various lines of his thought can be made to meet. However, that his was a mind unusually fruitful in strikingly original suggestions, no careful, open-minded reader of his writings will deny. That these writings have been so sadly neglected—that even now no collected edition of them is available—is to be accounted for only by the fact that isolation and neglect are the penalty for those who stray from the beaten path and refuse to bow to the reigning idols.

In one respect Peirce has certainly been most fortunate. Two such gifted and powerful minds as those of William James and Josiah Royce have been able to follow some of the directions from his Pisgah heights and have thus conquered rich philosophic domains. That further domains await those who can decipher other of his cryptic directions can, of course, only be a question of faith.

Of Royce's indebtedness to Peirce an eloquent testimony is contained in the preface to the "Problem of Christianity." In view, however, of Professor Howison's misunderstanding of that passage and its motive,[1] a student of Professor Royce may be allowed to

[1] *Philosophical Review,* May, 1916, p. 240.

testify to the frequency and generosity with which Professor Royce has, in his lectures and seminars, referred to the doctrines of Peirce. Besides, did not Professor Royce already indicate his indebtedness to Peirce in the preface to the "World and the Individual," in 1899? Any one who reads Peirce's essay on the "Law of Mind"[2] can see for himself something of the stimulus which led Royce to the utilization of modern mathematical researches in the service of idealistic philosophy. Royce's doctrines of social consciousness, of the mind of the community, and of the process of interpretation are strikingly anticipated in some of Peirce's earlier and later writings. Some of these resemblances may be due to the fact that both Peirce and Royce were close students of the frequently mentioned, but seldom read works of Schelling. But in some cases, as, *e. g.*, in the doctrine concerning the nature of mathematical reasoning and its objects, Royce follows Peirce very closely.

James's indebtedness to Peirce in regard to pragmatism has now become widely known. But attention should be called to the fact that James was no less indebted to Peirce in regard to his radical empiricism. It was the intellectual companionship of Chauncey Wright and Charles S. Peirce that during his formative period steeled James against the transcendentalism which dominated the Cambridge of that day.[3] Wright's influence was mainly in the direction of the old empiricism of Mill and Bain which led James to Spencer's "Psychology." The unquestioning belief in eternal unalterable laws of nature, that everything that happens happens precisely in accordance with these laws, was one of the main tenets of that empiricism. For the distinctive note of his radical empiricism, the opposition to the "block universe" and the belief that the whole world is changing and growing, James was indebted to Peirce as well as to Renouvier and Boutroux.

One of our American many-volumed sources of infallible information dismisses Peirce briefly and simply as a physicist. This is perfectly true as far as it goes. For many years Peirce worked on the problems of geodesy and his contributions to the subject, notably his researches on the pendulum, were at once recognized by European investigators in this field. The International Geodetic Congress, to which he was the first American representative, gave unusual attention to his paper, and men like Cellerier and Plantamour acknowledged their obligation to him.[4] This and other scientific work in-

[2] *Monist*, Vol. II., pp. 537 ff.

[3] See preface to James's "Psychology," and dedication to his "Will to Believe."

[4] See Plantamour's "Recherches Experimentales sur le mouvement simultané d'un pendule et des ses supports," Geneva, 1878, pp. 3–4.

volving fine measurement, with the correlative investigations into the theory of probable error, seem to have been a decisive influence in the development of Peirce's tychistic philosophy. Philosophers inexperienced in actual scientific measurement may naïvely accept as absolute truth such statements as "every particle of matter attracts every other particle directly as the product of their masses and inversely as the square of the distance," or "when hydrogen and oxygen combine to form water the ratio of their weights is 1:8." But to those who are actually engaged in measuring natural phenomena with instruments of precision, nature shows no such absolute constancy or simplicity. As every laboratory worker knows, no two observers, and no one observer in successive experiments, get absolutely identical results. To the men of the heroic period of science this was no difficulty. They held unquestioningly the Platonic faith that nature was created on simple geometric lines, and all the minute variations were attributable to the fault of the observer or the crudity of his instruments. This heroic faith was, and still is, a most powerful stimulus to scientific research. But few would defend it to-day in its explicit form, and there is little empirical evidence to show that while the observer and his instruments are always varying, the objects which he measures never deviate in the slightest from the simple law. Doubtless, as one becomes more expert in the manipulation of physical instruments, there is a noticeable diminution of the range of the personal "error," but no amount of skill and no refinement of our instruments have ever succeeded in eliminating irregular, though small, variations. "Try to verify any law of nature and you will find that the more precise your observations, the more certain they will be to show irregular departure from the law."[5] There is certainly nothing in our empirical information to prevent us from saying that all the so-called constants of nature are merely instances of variation between limits so near to each other that their difference may be neglected for certain purposes. Moreover, the approach to constancy is observed only in mass phenomena, when we are dealing with very large number of particles; but social statistics also approach constant ratios when the numbers are very large. Hence, without denying discrepancies due solely to errors of observation, Peirce has certainly ground for his contention that "we must suppose far more minute discrepancies to exist owing to the imperfect cogency of the law itself, to a certain swerving of the facts from any definite formula."[6]

To this belief in absolute chance variations, Peirce joined the doctrine that the limiting ratios which we call the laws of nature are

[5] *Monist*, Vol. II., p. 329.

[6] *Monist*, Vol. I., p. 165.

themselves slowly changing in the course of time. According to Peirce's grandiose conception, the very tendency towards law or regularity is itself the result of an accidental variation which has grown habitual with things. A good deal of his speculation in this field sounds mythologic, yet it is inherently as probable as the mechanical mythology according to which all spontaneity and novelty in nature are a delusion. By denying that the whole world can grow or increase in being, the mechanical philosophy must deny all the seeming increase in the diversity and specificity of things, since all that really is must have been from the beginning; and we are thus led to the position of Maxwell that the fundamental atoms out of which all things are made, are to-day precisely what they were in the day of their creation.[7]

The following,[8] published in 1868, is certainly in the spirit which leads to radical empiricism. "We can not begin with complete doubt. We must begin with all the prejudices which we actually have. These prejudices are not to be dispelled by a maxim, for they are things which it does not occur to us *can* be questioned. . . . A person may, it is true, in the course of his studies find reason to doubt what he began by believing; but in that case he doubts because he has a positive reason for it, and not on account of the Cartesian Maxim."

"Philosophy ought to imitate the successful sciences in its methods, so far as to proceed only from tangible premises which can be subjected to careful scrutiny, and to trust rather to the multitude and variety of its arguments than to the conclusiveness of any one. Its reasoning should not form a chain . . . but a cable."

James certainly shared Peirce's individualistic belief that at least in the early stages of any inquiry or branch of science "independence of thought is the wholesome attitude, and gregarious thought is really sure to be wrong"; and he undoubtedly subscribed to Pierce's attitude toward that outer thoroughness characteristic of the Germans and their admirers: "These men write the larger number of those books which are so thorough and solid that every serious inquirer feels that he is obliged to read them; and his time is so engrossed by their perusal that his mind has not the leisure to digest their ideas and to reject them."[9]

In his "Pluralistic Universe," William James has called attention to the similarity between the tychistic-agapism of Peirce and the creative evolution of Bergson. But while both tend to restore life

[7] Maxwell, in the conclusion to his text-book on "Heat."

[8] *Journal of Speculative Philosophy*, Vol. II., pp. 140–141.

[9] *Monist*, Vol. VII., p. 20.

and growth to the nature of things,[10] Peirce's approach has marked logical advantages. Bergson relies heavily on certain details not very accurately reported, as, *e. g.*, the supposed identity of the vertebrate eye and the eye of the scallop or pecten, which ignores the fact that similarities of this kind may be readily explained by the mechanical principles of convergent evolution. Peirce relies more on the general logic of specificity and individuality, into which the facts adduced by Driesch may well fit, but which have a much wider appeal since they are also applicable to the facts of inorganic nature, and can not be refuted by considerations drawn from experimental biology.

A closer similarity seems to me to exist between the tychism of Peirce and the probabilism of Cournot. Both vigorously opposed that blind anancism or mechanical necessity which has become the sacred cow of scientific orthodoxy, at the same time that they extended the range of our scientific knowledge. Both also relied on the method of infinitesimals, not in the obscurantist way which forms the basis of the general distrust of that concept, but in a way to keep the respect of a mathematician like Poincaré.[11] Cournot's massive books give the impression of a more delicate and finished mind, possessed also of a greater power of organizing his material which comes with self-mastery, but Peirce appears to me decidedly the more unconventional and the more fruitful of original insight. Peirce also had a vastly greater and more intimate knowledge of factual details, both of the history of human thought and of logical mathematical and physical methods. He knew enough of medieval logical terminology to make corrections in a work as erudite as Prantl's logic; and whenever he refers to writers like Aristotle or Kant his analyses show thorough mastery.[12] The same is true (so far as I can follow him) of his references to modern mathematical, astronomical, physical, and chemical researches. Yet his own original contributions entitle him to be regarded as one of the founders of modern symbolic logic.[13] Cournot has made more substantial contributions to the theory of history and of economics. But we gather from Peirce's chance remarks, such as his characterization of the Mugwump,[14] or of that which produces dominant opinion among professors,[15] that his eye

[10] Both Peirce and Bergson believe that on other than practical subjects natural selection need not favor our attaining truth.—*Popular Science Monthly.* Vol. XII., p. 3.

[11] *Revue de Metaphysique et de Morale,* Vol. XIII., p. 293.

[12] See, *e. g.*, his reference to Kant's "Transcendental Esthetic," *Journal of Speculative Philosophy,* Vol. II., p. 107.

[13] Schroeder, "Algebra der Logik," Vol. I., pp. 107 ff. Russell, "Principles of Mathematics," pp. 23, 376.

[14] *Monist,* Vol. II., p. 552.

[15] *Ibid.,* Vol. VII., p. 20.

for social facts was not undeveloped. At a time when it was considered a sign of scientific election or grace to regard all social changes as due to an immanent dialectic force, he saw clearly that the changes of social institutions and ideas depend on the change of conditions which facilitates the breaking up of habits. His keen psychologic insight is shown perhaps at its best in his attack on the now classical tradition that makes the process of thought consist of a succession of images.[16]

Recent neo-realism will find many points of contact with Peirce's vigorous anti-nominalism, and his equally vigorous opposition to the modern tendency to regard logic as a part of psychology. To the view that the laws of logic represent "the necessities of thought," that propositions are true because "we can not help thinking so," he answers: "Exact logic will say that *C*'s following logically from *A* is a state of things which no impotence of thought alone can bring about."[17] "The question of validity is purely one of fact and not of thinking. . . . It is not in the least the question whether, when the premises are accepted by the mind, we feel an impulse to accept the conclusion also. The true conclusion would remain true if we had no impulse to accept it, and the false one would remain false though we could not resist the tendency to believe in it."[18]

Since the days of Locke modern philosophy has been almost entirely dominated by the assumption that one must study the process of knowing before one can find out the nature of things known; in other words, that psychology is *the* central philosophic science. The result of this has been an almost complete identification of philosophy with mental science. Nor did the influence of biologic studies of the middle of the nineteenth century shake the belief in that banal dictum of philosophic mediocrity: "The proper study of mankind is man." The recent renaissance of logical studies, and the remarkable progress of physics in our own day bid fair to remind us that while the Lockian way has brought some gains to philosophy, the more ancient way of philosophy is by no means exhausted of promise; nor has man lost his interest in the great cosmic play. Those who have faith in the ancient and fruitful approach to philosophy through the doors of mathematics and physics will find the writings of Charles S. Peirce full of suggestions. That such an approach can also throw light on the vexed problem of knowledge needs no assurance to those acquainted with Plato and Aristotle. But I may conclude by referring to Peirce's doctrine of ideal as opposed to sensible

[16] *Journal of Speculative Philosophy*, Vol. II., pp. 152–154.

[17] *Monist*, Vol. VII., p. 27. *Cf. Journal of Speculative Philosophy*, Vol. II., p. 207; *Popular Science Monthly*, Vol. LVIII., pp. 305–306.

[18] *Popular Science Monthly*, Vol. XII., p. 3.

experiment, and to his treatment of the question how it is that in spite of an infinity of possible hypotheses man manages to make so many successful inductions.[19]

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1. "Questions Concerning Certain Faculties Claimed for Man," pp. 103–114.
2. "Some Consequences of Four Incapacities," pp. 140–157.
3. "Ground of Validity of the Laws of Logic," pp. 193–208.

These three papers, somewhat loosely connected, deal mainly with the philosophy of discursive thought. The first deals with our power of intuition, and holds that "every thought is a sign." The second, one of the most remarkable of Peirce's writings, contains an acute criticism of the Cartesian tradition and a noteworthy argument against the importance of "images" in thinking. The third contains, *inter alia,* a refutation of Mill's indictment of the syllogism.

B. Review of Fraser's "Berkeley," in the *North American Review,* Volume CXIII. (1871), pp. 449–472.

This paper contains an important analysis of medieval realism, and of Berkeley's nomenalism. (A Scotist realism distinguishes Peirce's pragmatism from that of James.)

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[19] *Monist,* Vol. VII., p. 206; *Popular Science Monthly,* Vol. XIII., pp. 213 ff, and his essay in "Logical Studies," pp. 175 ff.

[1] The following classification is arbitrary, as some of Peirce's most significant philosophic reflections occur in papers under headings II. and III. It may, however, be useful.

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10. "Prolegomena to an Apology for Pragmaticism," Vol. 16, pp. 492–546.

The first six papers give the fullest development we have of Peirce's metaphysical system, *i. e.*, of the doctrines of tychism, synechism, and agapism. See criticism by the editor of the *Monist,* Vol. 2, pp. 560ff., and Vol. 3, pp. 68ff. and 571ff., and McCrie, "The Issues of Synechism," Vol. 3, pp. 380ff.; cf. Dewey, "The Superstition of Necessity," Vol. 3, pp. 362ff.

The last four papers develop Peirce's thought by showing its agreement and disagreement with the pragmatism of James and Schiller. The last paper contains his Method of Existential Graphs.

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2. "Dmesis" (on charity towards criminals), pp. 3397–3402.
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and the premise of an argument. Contains also an interesting note (pp. 283–284) denying the positivistic maxim that, "no hypothesis is admissible which is not capable of verification by direct observation.")

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"The Postulates of Geometry." April, 1902.
"The Color System." April, 1902.
"Note on the Simplest possible Branch of Mathematics." April, 1904.
"Topical Geometry." November, 1904.
"The Relation of Betweenness and Royce's O Collection." November, 1905.
"Existence Graphs." April, 1906.
"Phaneroscopy." November, 1906.
"History of Signs, Relations, and Categories." November, 1906.

Judged by the abstracts of the paper on "Topical Geometry" which appeared in the daily newspapers (no official account is published), it must have dealt with the logic of topology—as an instance of the logic of non-quantitative mathematics. Peirce alludes to the subject in the *Monist,* Vol. 7, p. 205. Its publication would be of great value.

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REVIEWS AND ABSTRACTS OF LITERATURE

Probleme der Entwicklung des Geistes. Die Geistesformen. SEMI MEYER. Leipzig: Verlag von Johann Ambrosius Barth. 1913. Pp. iv + 429.

Here is a serious valuable discussion of practically all the deeper questions that to-day confront pioneers in the land of psychology, a discussion carried forward with important logical and metaphysical problems occasionally in mind. Of books on mental development, it treats the widest range of topics and is often most penetrating, although students of psychology will miss many familiar captions from the table of contents. The treatment has both originality and charm, the latter consisting of a steady unfolding of the argument and frequent sympathetic pictures of actual mental life. Many problems are stated and deliberately left unanswered, but I lay down the book with the reflection: Here is a new whole picture of the mental life, one that makes genial important contributions to current discussions in psychology and logic. It contains no specific references and no bibliography, but doctrines from practically the entire literature of the subject are alluded to and discussed.

Meyer disclaims any world-view that might influence his treatment, except the convictions, that in this world something can really begin to be, and that the human mind is not the goal toward which all development points. Every bearer of spiritual energies possesses, in the form of mental life with which it is endowed, as good a goal of development as does man. Development is always complete, but never at an end. It is nowhere constant; it nowhere results from permanently active forces comprehended in life itself; it is not in itself a property of life. Development is creation, not an unfolding of given or implicit possibility. There is a struggle for existence. The world is not a well-ordered unity, but a world in which accident gives rise to new creations which are the variations out of which the life-struggle selects. Practise is not the highest functional principle of development, and it is the last force to be regarded as creative. Practise is a form of learning, of memory-functioning, and between memory and heredity there is no bridge. Practise establishes more firmly relations of movement to stimulation, but it possesses no power to improve performances of any kind; and no function can create its organ through practise. Performances are improved through ever finer discriminations and ever farther reaching adaptations of movements to ends held in view. That every form of activity becomes easier and better by repetition is a profound error.

The origin of consciousness is bound up with organic evolution, and to read into primitive organisms the volitions of mature men, or the consciousness men have of their activities, is wholly unwarranted by facts. On the other hand, the life of an organism and the work of a machine are not comparable. The fundamental functions of consciousness are discrimination and choice; and consciousness consists of its phenomena. It is hardly possible to determine where consciousness first appears. Its distinguishing mark has not yet been found, and it may well happen that a proof will one day be forthcoming that there can as little be such a thing

as a squaring of the circle. In general, the capacity of any creature, in the light of experience, to change his response to stimulation can be said to be the work of consciousness, and many investigators incline to regard this as its lowest form. Memory is not the mark of consciousness. There must be an original consciousness consisting of a timeless- and spaceless-sensing, that assists in simple discriminations between present stimulations, before memory can come and mediate a comparison with earlier experienced impressions (Eindrücke).

First is the world, and then comes man; but he comes not as a goal and completion; he comes as a bit of life, as a tiny bit of the whole of life, and as a disappearing appearance in the driven incidents of the world, possessed of a mind endowed only to meet the needs of life and not to unite in itself the streaming tendencies of the universe. The world does not mirror itself in our consciousness: its forms are created as aids of life: sensations, the earliest building stones of consciousness, are primarily signals, and further, the usufruct of intensities of stimulation that owing to their diminutive energies could not move the body as a whole. There are certainly, in the great world of life, more forms of sensation than we possess, and it is possible that certain creatures are more richly endowed than we are. Our senses are accidental creations, mere outposts, whose significance is derived entirely from their connections with other and more elaborate modes of response. Knowledge of the world arises solely as the after effect in consciousness of our movements.

Feeling arises out of a conflict of inner tendencies and demands. Without such a conflict, no function for feeling is recognizable and there is no aim. For that reason feeling is a relatively late acquisition of the mental life. There is something in the James-Lange theory of the emotions, but feeling is no mere sensation of bodily processes; for the body could not evaluate, there is no mechanism of the brain for it. With evaluation begins the realm of purely mental (or spiritual) laws. The problem of the origin of feeling points unmistakably to behavior, not to stimulation, for its solution; feeling must find possibilities of movement already there. As the basis of valuation, and so of choice, it gives to the mental context its character and coherence.

Instincts do not arise from volitions, and the word impulse only names, it does not explain, the connection between stimulation and response in them. The problem of the origin of that connection is for us unsolvable. Feeling comes later than sensation and perception, pain being a relatively recent acquisition. Feeling takes the place of instinct as a guide of movements, and man behaves only through feeling. The very few instincts that remain to him must be coupled with feelings in order not to disappear from life. Animals are probably not moved by feeling to protect themselves. Expressive movements of course preceded the feelings they express.

Memory appeared late in the animal series. Recall is a special case of memory, not the conscious side of all of it. Memory underlies our total knowing, but knowing is timeless, and recall involves the time-relation. There is a timeless memory upon which we rely all day long, and no lower

animal possesses a temporal memory. Memory is nothing less than it is a time-consciousness. Memory works mechanically, not according to mental laws: it is only capable of providing a material for the activity of consciousness, and again, of preserving the results of mental activity. The actual course and content of memory is in part the result of selection and interest, which are mental functions; but these are not in any sense functions of memory. Our thinking is of a character to be served by the brain-mechanism that underlies memory, and where that fails the mind has no means of filling out the breach.

Will is not the mover of the body: the latter moves itself: its movements must have already been constructed either in the development of the species or in the life and learning of the individual: the will simply takes in hand the work of making behavior significant to the agent. No movement is thinkable without some stimulation *ab extra,* for will can not take the place of stimulation. An end is the essence and actual being of will, and there is no will where there is no opposition to the even course of customary activities. Man is dependent upon acquiring will, for which he is chiefly indebted to culture, *i. e.,* to the spiritual community for which he is born. We do not will our movements, we will results, and results do not rest on knowing how to move. We note the result, remember it, and even connect it in perception with the stimulation that gave rise to the movement; but no direct way leads from the subsidence of hunger as a result of eating to the construction of the eating movement. There are no unconscious or subconscious mental activities. Skill and technique depend upon acquiring an appropriate perception of the object, and this remains in memory like any other temporal and spatial combination. Of special importance are inherited adjustments due to the direction and distance of the source of stimulation, especially those connected with sight and hearing, for, to the building of movements, they contribute the indispensable space element. It is a result of these movements, known only to scientists, that we construct a unified visual space into which we translate all space-experience.

The mechanization of conscious processes through fixing them by practise is clearly possible; while consciousness, thus freed from the work of carrying on these acts, devotes itself to other attainments, and so multiplies its effects. Consciousness thus abbreviates, while memory supplements and completes, its activities. The aims that occupy the attention in volition continually undergo reconstruction in these ways: Every step of growth in mental media brings new aims in sight. Hence, no aim, such as the aim of any act of ours, precedes evolution.

Perhaps the most interesting section of Meyer's book is devoted to complementation and abbreviation (*Ergänzung und Verdichtung*). Here the work of memory is represented as linking together, always in the service of behavior, not images, but things and occurrences, and thus providing the materials on which conscious activity works. The linkages are not mysterious mental bonds of association, but activities of a mechanical type in which our bodily-mental organism is either directly or indirectly involved. Memory produces linkages in the contents of life itself, and

Meyer questions whether images are in themselves of any importance in memory activity. Memory can only work the past into the present situation, the most useless definition of it being the power of representing absent things. Memory saves us from beginning at the beginning of experience every time we do anything. We need above all the vast supplementation of the present that comes from knowing and remembering the experience of predecessors, the use (*Gebrauch*) of the object (*Gegenstand*) being the fundamental relations to which all its properties are subordinated. Movements are constructed by the mind itself only on the highest planes of life.

Memory does not in the least account for or create unity, unification, and judgment. Feeling, interest, and will, the conscious setting of ends, are appealed to to account for the unity of the thing in perception and, I may as well add, the unity of consciousness and personal identity. The unification of the thing in perception is rather a presupposition of memory activity than one of its performances: and yet, unification is not "the work of the mind" so much as a result of many factors, among which memory must be counted. In dealing with the problem of unity, the temptation is especially great to assume in an explanation what is to be explained (as Kant did). It is not the mind that produces unities by its activity, but consciousness consists of unitary constructions: out of the given contents, taken together with those supplied by memory, new unities develop by a law of their own. Unity is for consciousness a necessity, but it is no force that can create anything at all. It is indeed a limitation. The forms of unification, such as simple combination and blending, abbreviation (*Verdichtung*), simplification and representation, are not forms of the activity of consciousness; they are results which we are conscious of. The correlating and organizing processes that result in unity are extra-conscious: they are not even mental. The important side of the unity of consciousness is the attitude of the organism toward the outer world. This unity of attitude toward things is an effect of nervous functions, and their unity is a presupposition of the much discussed unity of consciousness. Certain it is that the connection of stimulation-reception to response must take place through nervous transmission; and just as certain is it that mental unity is something more than a process organized like a nervous function. The unity outward can only spring from a peculiar inner unity, which at bottom is volitional. The will consists in nothing but the fact that one thing is subordinated or suppressed by another; and in no one person could one will get along with another, for their demands would struggle for precedence. Most of the difficulties of the problem of unity of consciousness result from the fact that all contents of experience are transformed into things by being thought. (We who speak English can only envy the users of a language containing such words as *Verdinglichung*.) Our will each moment is our self; our whole individuality is a will-unity (*Willenseinheit*); but the unity of the will is nothing but the sum of our bodily and mental functions concentrated upon an end. So long as oscillation continues, the personality shows its unity just in the necessity of coming to a conclusion. There is no partial will, for will is

only capable of a complete unity. And yet, only a living being that from the first prepares to build a spiritual community could with success, and then with such enormous success, enter into a life directed and judged according to ends. A solitary individual could never acquire such knowledge as to render his life secure, and even the step of individuating the simplest thing presupposed at least the beginning of a community in which one imitates another. And the first *thing* is an instrument, in which one property predominates over all others.

Space-perception begins with the apprehension of the directions in which we approach things and see them affect us. The senses are from the first accommodated to the direction of stimulation, and this accommodation is a directing of the attention toward the thing. The space of science, with its three dimensions, its continuity and uniformity, its conceivable emptiness, its endlessness and endless divisibility—scientific space is a concept which a man who does not think scientifically is not able to construct at all. We never perceive space of this sort: we perceive the location of a thing. And there is no end to the number of directions possible to stimulations and movements. There is no special space-sense, although vision predominates in space-perception. The controversy whether space-perception is inherited is an idle one: many of its conditions are inherited, but every space relation is an experience. It is not a thing, although psychologists and other scientists alike tend to think of the space of science as a thing. Primarily it is nothing but the measure and direction of movements.

Experience is primarily timeless; in joining an earlier event with the present, it merely works the past into the present: through memory, the past becomes again effective, and so a piece of the present. A time-consciousness is a purely human possession; and, for that reason, no animal has a genuine life course or destiny. The time-consciousness does not rest upon the consecutive flow of mental states. A creature that adapts himself only to the immediate present constructs no time-consciousness. The occasion for comparing a present situation with any other can only arise out of an urgency to use the present for the activity of another time; and, only a being that himself sets ends for his actions comes into a position to order his experiences in this way. The beginning of the time-consciousness is not at all the antithesis of past and present: the present is first contrasted with a future held before the eyes. In retrospect, when the future has become the present, the former present has become a past. Only one who makes plans for the future looks back into a past (p. 394). Things and events do not exist *in* space and time, space and time exist in them.

The attempt in a review to give a book of such scope as this one is perhaps foredoomed to failure; and yet, such an attempt, in this case, seemed more worth while than any brief discussion of special points. Meyer maintains that mental development will always be a field of controversy, and what might be called the pluralistic biological tychism of the work is sure to provoke opposition. Especially the dualism of "mechanical" memory activity, instinct, and habit in antithesis to mental activity

with its laws of discrimination, evaluation, and choice, seems to be an intolerable gap in the theory. But the book, as a whole, rings true. Especially those who are interested in the instrumental view of consciousness, and the behaviorists, with their new philosophy of mind, should welcome it. And Meyer's contention, that any doctrine of human knowledge that does take mental development into account must be judged unfruitful, is supported by a weighty mass of evidence in this book.

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The Yoga-System of Patañjali, or the Ancient Hindu Doctrine of Concentration of Mind, Embracing the Mnemonic Rules, Called Yoga-Sūtras, of Patañjali, and the Comment, Called Yoga-Bhāshya, Attributed to Veda-Vyāsa, and the Explanation, Called Tattva-Vāiçāradī, of Vāchaspati-Miçra. Translated from the original Sanskrit by JAMES HAUGHTON WOODS. Harvard Oriental Series, Edited by Charles Rockwell Lanman, Vol. 17. Cambridge, Mass.: The Harvard University Press, 1915. Pp. xlii + 384.

This contribution to the Harvard Oriental Series, by Dr. Woods, professor of philosophy in that university, continues the tradition of austere scholarship manifest in earlier volumes. No translation of either the "Comment" or the "Explanation" has before been published in America or Europe, and since the bare Sūtras can be crowded into ten pages of text, by far the major portion of this solid tome is unique in the West. Without it as a source there can hereafter be no serious study of the Yoga philosophy unless by the few who are willing to rely on their own reading of Sanskrit.

To the Yoga Sūtras Dr. Woods ascribes a date as recent as A.D. 300–500, the commentary being placed at 650–850 and the sub-commentary at about A.D. 850. This does not mean, however, that there was no Yoga before Patañjali wrote. In order to get the full meaning from the text one needs to practise upon it some of the Yoga methods of concentration. Besides the ordinary difficulties of entering into an alien philosophy are the special ones of catching abnormal mental experiences. Impossibility of accurate reproduction in words is a trait of mystical conditions the world over. A cynic falling upon some parts of the commentaries would say that they were intended to befog the Sūtras. This, however, is not quite fair; they contain much that is illuminating. But they multiply manifold the problems of exegesis, and it is well understood, of course, that a native Oriental commentator, although standing nearer the original author, is often less able to judge his meaning than is the modern critic.

Yoga is familiar by name and in general character as one of the six orthodox philosophies within Hinduism. Very imperfectly we might distinguish it from the two others most celebrated by saying that, while the Vedānta follows pantheistic idealism and the Sānkhya atheistic dualism, the Yoga is a mildly theistic variant of the Sānkhya, but is chiefly concerned with ways and means of self-hypnotism. Yoga, a word cognate

with our "yoke," is often taken to mean union with Deity. From Patañjali's viewpoint, however, the end of the Yogin's endeavors is "Isolation" (*Kāivalya*), that is to say, a realization that he is a part of *Purusha,* the Self (universal, but not now regarded in its divine identity) and thus independent of animal body and soul with their vicissitudes. Before this differentiation is produced, the Self is seemingly perturbed by the fluctuations of the organism with which it is associated and confused, like the moon reflected on the waves.

Separation or discrimination is brought about by concentration. Methods of weakening hindrances thereto are several, such as suppression of passion, or as study, morality, sympathy, postures, breathing exercises, and devotion to Içvara, the Lord. The last mentioned is coordinated with other expedients and Içvara is not here represented as the Infinite Goal.

Dr. Woods considers a primary historical importance of these texts to be their formation of "a bridge between the philosophy of ancient India and the fully developed Indian Buddhism and the religious thought of today in eastern Asia. . . . For this system, together with the Nyāya and Vāiçeshika systems, when grafted upon the simple practical exhortations of the primitive Buddhism, serves as an introduction to the logical and metaphysical masterpieces of the Mahāyāna." Presumably he refers to influences upon Buddhism much later than the first infiltration of practises resembling the Yoga. Some of the oldest books of the Pāli canon show the Jhāna trances to be in vogue. Thus the Vinaya and Nikāyas contain minute instructions for the breathing exercises, and it is asserted that Buddha himself practised them. The antiquity of such devotions among his followers is proved by the attention they receive in such primitive compositions as the Thera-Gāthā hymns, and it is hardly conceivable that they could have found so large a place thus early without the Master's favor. These mysteries should not, however, be called Yoga in too technical a sense, but regarded as springing from a root common to Hinduism which later flowered most gorgeously in the Yoga cult. That there is a close relationship between Yoga and other orthodox sects goes without saying. One of the strongest impressions made by this book is its attestation of the connection between Yoga and the heretical religion of Buddha. Philosophically, to be sure, they are opposites, for the existence of any Self that could be isolated from its natural organism was a doctrine that Buddha most ardently combated. Their similar ecstasies thus led to quite different attainments, equally satisfying to the respective votaries, a fact which does not strengthen the confidence of a modern critic in either one. But fruitful quest in the Sūtras for formulæ cognate with Buddhist expressions gives a relish to their perusal. Thus, the classification of pain, (its cause, the means of escape, and the eight aids to Yoga) is undoubtedly a reflex from the "Four Noble Truths" of the Dhamma. We find also here, as in the Tipitaka, the "Four Infinite Feelings," which characterize Hinduism at its best: friendliness, pity, congratulation, and peace, to adopt a free rendering. Among the supernormal powers produced by Yoga one meets the same ideas as in Pali literature: memory of former lives, clair-

voyance, apprehension of the celestial bodies, elephantine strength, levitation, etc. Book III. of the Sūtras merits detailed comparison with the Ākankheyya Sutta, translated in Vol. XI. of the Sacred Books of the East. With Patañjali's reference to cotton-down in describing the miraculous lightness of body, compare Thera-Gāthā 104. Knowledge of the cries of animals is a fabulous power not confined to India; Philostratus, in his "Life of Apollonius of Tyana," attributes it to the Arabs. A sane lover of Buddhism, however, looks upon all such pretensions as smirch from the muddy waters of Hinduism in which it had grown and from which it could not, like the lotus in its favorite metaphor, preserve itself immaculate. One is glad to believe that its practise of trance was not vocational, but avocational.

Such works as this raise an obstinate questioning how far it is desirable to translate unconvertible and doubtful terms. Where minds have flowed in deep, un-European channels, it is impossible to express their thoughts in concise words of our language. Wine new to us requires bottles that also will be new. The wisest course in a translation for the use of scholars might be to naturalize the most important Sanskrit technical terms, richly defining them in a glossary, and thus indicating their subtile meanings more clearly than by approximations possible in the text. This would be less urgent if the English renderings were standardized, but where an effort at originality is made by each new translator the reader is confused. These observations are not to be taken, however, as an attack upon Dr. Woods, who has seen fit to aim at English equivalents for almost everything, but who has often added the originals in parentheses, besides appending an index to the Sanskrit words in the Sūtras.

Perhaps it is fortunate that the form of the Yoga Sūtras and their commentaries restricts their perusal to serious students and that hot-headed faddists will effectually be repelled. In the opinion of this reviewer at least, mysticism—especially that selfish mysticism which, like Yoga, is its own end—has ever been the bane of religion, and its engrossment of attention is largely to blame for toleration of cruelty in the world to-day. Duty is not served by intoxications which make the mind forget reality, but by keeping it clear for truth and sympathetic projection. But however dubiously we may praise the work of Patañjali and his interpreters, it is no reproach to Dr. Woods nor a detraction from the applause to which he is entitled for the achievement of his heroic task. Notable is the restraint with which he has held himself to the work of a translator and refrained from annotations other than brief technical ones. His comparative citations indeed show a wide range of study. Doubtless he holds in reserve many valuable opinions as to the meaning of the Yoga which he may disclose upon a suitable occasion. Students of philosophy and psychology, after exercising with the analyses of mental conditions now laid before them, will not feel themselves above assistance, and those who deal with morbid mentality will welcome more light upon this matchless system for crucifying sanity.

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Das Problem der Geltung. ARTHUR LIEBERT. Kantstudien. Ergänzungshefte im Auftrag der Kantgesellschaft herausgegeben von H. Vaihinger, B. Bauch und A. Liebert. No. 32. Berlin: Verlag von Reuther und Reichard, 1914. Pp. vi + 262.

The author of the present monograph in the series supplementary to the "Kantstudien" is an adherent of Neo-Kantianism, (pure logism, critical rationalism). This movement, founded by F. A. Lange[1] and Otto Liebmann[2] with the slogan "Back to Kant!" has perhaps as its leading representatives the celebrated school of Marburg headed by Hermann Cohen and of which Liebert himself is presumably a member (pp. 165, 238). The Neo-Kantians are quite ready to deviate from the philosophy of Kant on the ground that "the individual doctrines of the 'Critique of Pure Reason' are controversial or doubtful or disproved"; yet they claim immortality for the general position which underlies this work as a whole. The views of the school of Marburg, which differ[3] in important respects from the idealism of Lange and Liebmann, are carefully outlined by Liebert, who also refers to the excellent sketch[4] of Natorp (pp. 237–246). As Liebert says, the beginning and end of Cohen's philosophy is the concept *system* (p. 246); the fundamental rôle, therefore, ascribed to this concept by Kant is endorsed (pp. 114, 194).

As might be conjectured from the universality of system or whole in Neo-Kantian philosophy (*cf.* p. 186), the main thesis which Liebert seeks to establish is that system is the basis of all validity. The author confesses that certain Neo-Kantians, *e. g.,* Natorp, have maintained an attitude of reserve toward the concept of validity, possibly because they suspected that the latter was to be employed in the construction of a new metaphysics or the revival of an old, such as Neo-Fichtianism (dogmatism) which is strongly opposed (pp. 158, 174). On the contrary, metaphysics Liebert subordinates to psychology; metaphysics, indeed, is hypostasized psychology (pp. 23, 120, 247), while psychology itself is distinct from logic, in conformity with Kant.[5] There results, then, that there are but two autonomous series of validity: the psychological and the logical. Accordingly, Liebert discusses (*a*) the psychological significance of validity (pp. 22–56) and (*b*) the logical aspects of validity (pp. 96–189). The latter Liebert considers more profound than the former and less successfully discussed by previous authors. In fact, Liebert regards the demonstration of a sphere of validity which is essentially distinct from the psychological as one of the peculiar contributions of critical philosophy. A critico-historical review dealing with relevant philosophies is appended to each section; these are primarily the philosophies of James and Kant.

System, or unity, is conceived by Liebert to be an infinite structure ordered according to laws (p. 103) as distinguished from a mere aggregate. It is not a closed or perfect totality, but an infinite problem (*cf.* p.

[1] "Geschichte des Materialismus," 7te Auflage (1902).

[2] "Kant und die Epigonen," reprinted, Berlin, 1912.

[3] For example, there are diverse interpretations of Kant's "Thing-in-Itself."

[4] "Kant und die Marburger Schule."

[5] *Cf.* p. 122, note; p. 204.

234); a "continuity" in a spontaneous and autonomous state of development (pp. 114, 122, 152). System is a *fundamentum* of knowledge; every individual concept is only a determination of the thought of system with reference to a definite place in the latter (pp. 35, 109, 115). After characterizing the metaphysical and psychological concepts of system (p. 120) Liebert determines the logical concept negatively (pp. 121, 122) and finally identifies it with the idea of knowledge in a Kantian sense (pp. 122–126). Liebert discusses the psychological and metaphysical interpretations of the Kantian ideas, namely, those of Vaihinger and Fichte and then takes up the methodological meaning of the idea of system, in particular its relation to the *categories, induction* and *deduction, nature, mechanism, experience, teleology* and *being* (pp. 135–167). In a final section of the second part of his monograph, Liebert critically considers the ultimacy of the idea of system, especially with reference to the philosophies of Fichte, Lotze, and Münsterberg (pp. 167–182) and concludes with a defense of its autonomy. Liebert rightly observes that the writing of a history of the concept of system would be a most valuable and fascinating task. It would probably be instructive to compare in detail the properties of the Neo-Kantian conception of a whole with the Hegelian interpretation. Liebert has only a remark or two in this connection (*cf.* p. 114) and subsequently points out the lack[6] in the literature of an exposition of the relation of Hegel to Kant (p. 192).

Referring more specifically to validity, Liebert assumes that system is the supreme determination of validity (p. 117; *cf.* p. 125). Indeed, the fundamental values of the validity of knowledge, the indispensable conditions and functions of the latter, are *concept, judgment, inference, method,* and *system* (p. 116). The idea of system is the pure form of the concept of validity (p. 143). Owing to the systasic quality of system an individual concept, as such, is artifical, without validity (p. 109). An individual term, then, is valid if, and only if, it is an element in the system, a part of the whole, that is, exercises a function in the system (p. 116). This functioning consists in the generation of (internal) relations which are themselves mere abbreviations of the thought of system and thus possess universal validity and necessity (pp. 115, 183). Validity appears to be synonymous with truth (pp. 109, 114, 206). It remains briefly to characterize validity with reference to being and reality. All thought possesses structure and there can be nothing external to thought (pp. 62, 143). Hence being is the thought of being. But to think is to think of something as valid; even non-validity possesses validity in thought. Therefore the thought of being implies that being is valid. Thus being is merged into validity (*cf.* p. 9). Objectivity, *i. e.*, objective validity, merely means "grounded in the fundamental laws of thought" (pp. 103, 239). Reality is not a mere fact; it is conceptual. To be real is to possess functional and categorical validity (pp. 129, 161, 183). This position, so carefully delineated by Liebert, is in the strongest possible contrast with the statement of James: "The question of being is the darkest of

[6] In a volume dedicated to Theodore Lipps, Leipzig (1911), pp. 1–25, the relation of Neo-Kantianism to Hegelianism is discussed by E. v. Aster.

all philosophy; all of us are beggars here." Such a view, one readily infers, would be rejected by Liebert as mystical (*cf.* pp. 55, 163) since according to him the slightest attempt to determine reality presupposes the concept of reality, and the validity of concepts is absolutely autonomous. It has become pretty well recognized, I think, that the Neo-Kantians, in adopting such an extreme standpoint, have committed an important error.

Concerning the logical position, as a whole, of Liebert and other Neo-Kantians it will perhaps suffice to note its dependence upon Lotze and his interpretation of the Platonic Ideas. The arguments of Dewey in his "Logical Studies" controverting Lotze are, of course, widely known. An opportunity for further criticism is offered by the Neo-Kantian relation of science to philosophy, or rather, the actual interpretation of this relation by individual members of the school, for, taken by itself, this part of their programme, at least as stated, *e. g.*, by Riehl, largely represents a praiseworthy ideal.[7] On this basis, philosophy is defined[8] to be (in harmony with Windelband) the "critical science of universally valid values." Critical philosophy seeks to determine the fundamental laws of science in general. Philosophy and the positive sciences are, therefore, interdependent. Through this interaction of criticism and creation the future development of scientific philosophy will consist in the elevation of science to philosophy. Thus the importance of creative scientific activity in philosophers is clearly recognized. It would not he difficult to show that Neo-Kantians such as Cohen, Natorp, Windelband, and others have fallen lamentably short of the standard proposed by Riehl, although they assert[9] that they are chiefly interested in the mathematical sciences. Liebert evinces the same failing: it is hardly correct for him to say[10] that Kant's "Critique of Pure Reason" contains the critical foundation of Euclidean mathematics. But, whatever the mathematical deficiencies of the Neo-Kantians may be, one must admire the thoroughness, even brilliance, with which Liebert and his colleagues have described their philosophy, and in particular the adaptation of the latter to the problem of validity.

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Modes of Research in Genetics. RAYMOND PEARL. New York: The Macmillan Company. 1915. Pp. 182.

This little volume comes as a timely addition to the working library of the modern student of biology. While three of the five chapters are substantially reprints of separate addresses or papers by the author, and a fourth is based upon a series of studies published elsewhere, the general account marches with reasonable unity to the end without undue evidence of scissors and paste.

[7] *Cf.* Liebert, *loc. cit.*, pp. 249–256.

[8] *Cf.* Liebert, *loc. cit.*, p. 21.

[9] *Cf.* Liebert, *loc. cit.*, p. 241.

[10] *Loc. cit.*, p. 111.

Although the veteran will read it with profit, the book will prove especially useful to the beginning investigator, inasmuch as it will aid materially in orienting him in the technique of his subject. The first chapter reviews and criticizes current modes of research in genetics. After a reminder that in dealing with phenomena of heredity, not only resemblance between adults, but the entire cycle of reproduction of the individual, including both gametogenesis and somatogenesis, must be reckoned with, the author proceeds to evaluate the four chief methods of investigation,—the biometric, the Mendelian, the cytological, and the embryological—by which biologists are striving to solve the problems of genetics. The advantages and limitations of each method are impartially set forth.

The second and third chapters together afford a concise and understandable summing up of the content, limitations, and real utility of biometry in genetics. They reveal convincingly its value as an indispensable refinement of the descriptive method. It is to be regretted that, for the sake of the tyro, the author did not follow up his lucid discussion of the significance of biometry by an additional chapter explaining the commoner terminology and symbols used in it together with illustrative applications.

The fourth chapter, "Certain Logical and Mathematical Aspects of the Problem of Inbreeding," although rather abruptly interjected into the book, is an interesting elaboration of a method for analyzing and expressing numerically, in the form of coefficients, degrees of inbreeding. Starting with the obvious fact that the total number of different ancestors of inbred individuals are fewer in proportion to the degree of inbreeding, down to an ultimate minimal limit, the author develops a series of values of successive coefficients of inbreeding in such matings as brother by sister, parent by offspring, cousin by cousin (single and double), and uncle by niece. The most interesting practical outcome shown in his tables and graphs is that if any of these forms of inbreeding are followed continuously, by the tenth generation there is an almost complete unification of ancestry.

The last chapter, which discusses the relation of the science of genetics to the practical art of breeding, although adding nothing to the earlier discussions of methodology, sounds a needed caution about what, particularly in the field of animal breeding, may be expected in a practical way from the application of Mendelian principles.

In conclusion, we can heartily agree with the author that "an occasional examination and overhauling of one's equipment is as essential to success in scientific operations as it is in military," and congratulate him upon his success in conducting us through the inspection.

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